(12)UK Patent Application (19)GB (11) 2 045 497 A
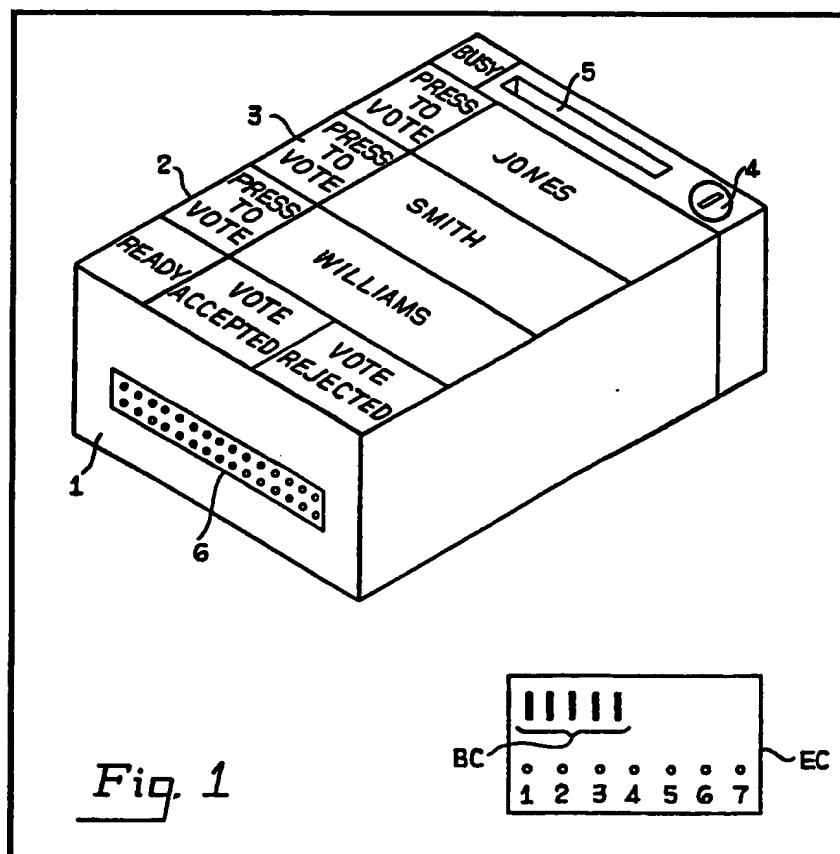
(54) **Electronic voting machine**

(57) A portable voting machine 1 suitable for use in current polling booths having a vote selection display area 2 layed out in a manner similar to an existing voting slip and including a voting pad 3 for each vote selection. The machine including electronic counters arranged to register the manual activation of a voting pad 3 and being unlocked for use only upon reception of a suitably encoded card EC upon which is also recorded the vote selection. The encoded card EC being retained within the voting machine after a vote registration operation is complete.

Fig. 1

GB 2 045 497 A

Fig. 1

Fig. 2

S0 FREE LAMP ON

S1 CARD IN READER ? n

y
CP

S2 BUSY LAMP ON

S3 BAR CODE OK ? n CRR → REJECT LAMP ON S4

y
CROK

S5 ISRB SET ? y / n

S6 OPERATE OP

S7 VOTE CAST ? n → S8 ? n

S8 y TIME OUT MATURED

y
VC

S9 LOCK OUT VOTE LATCHES

S10 DRIVE CARD PUNCH

S11 ACCEPT LAMP ON

S12 RELEASE CARD → BUSY LAMP OFF → RESET VOTE LATCHES
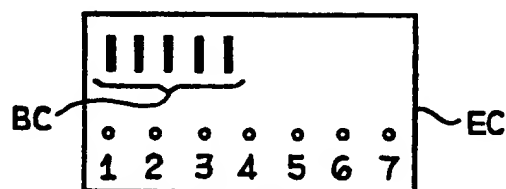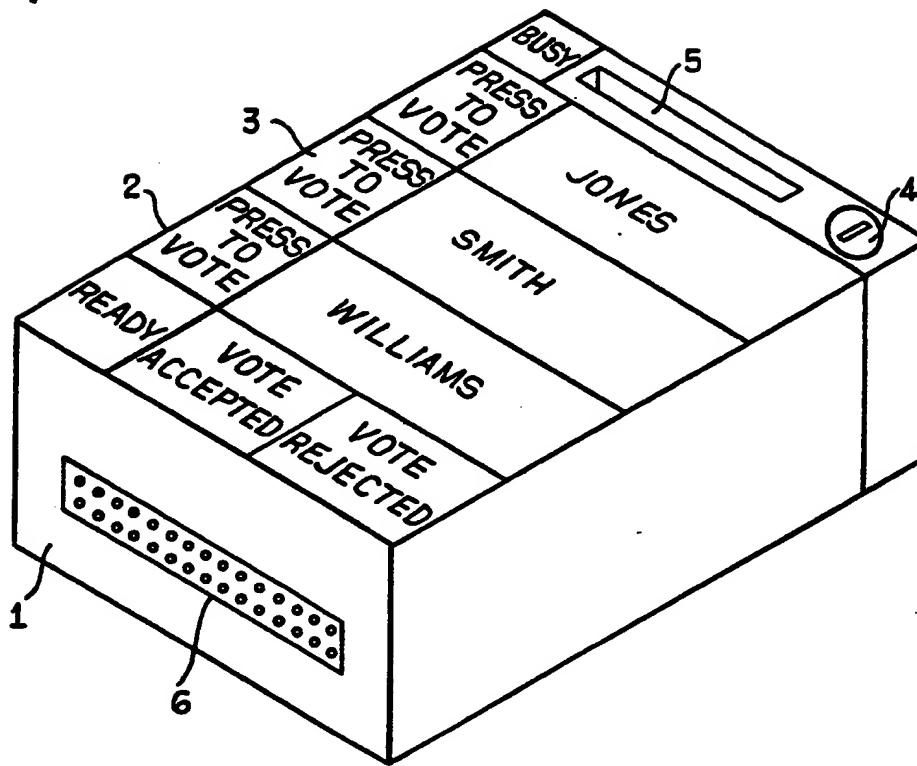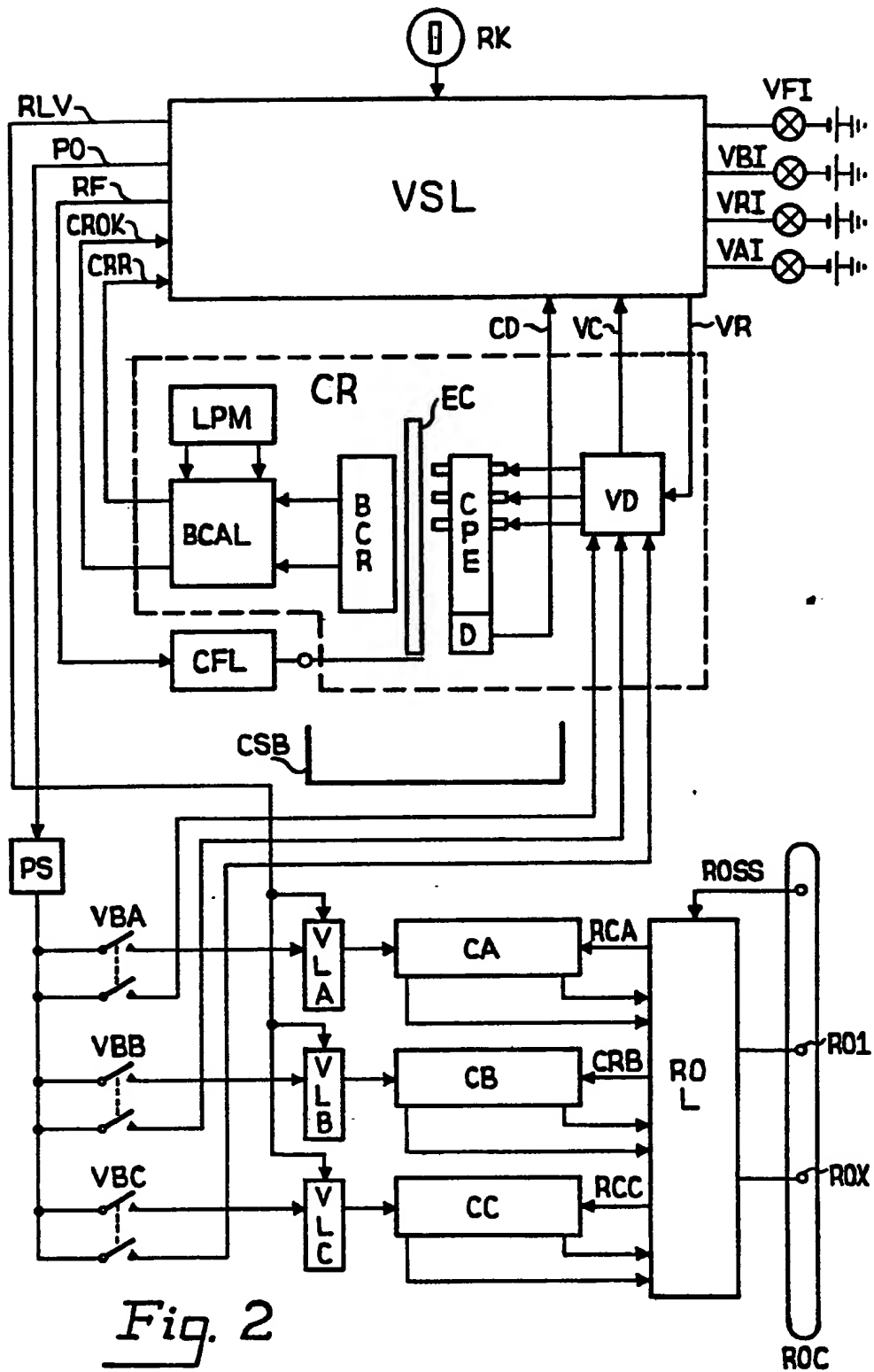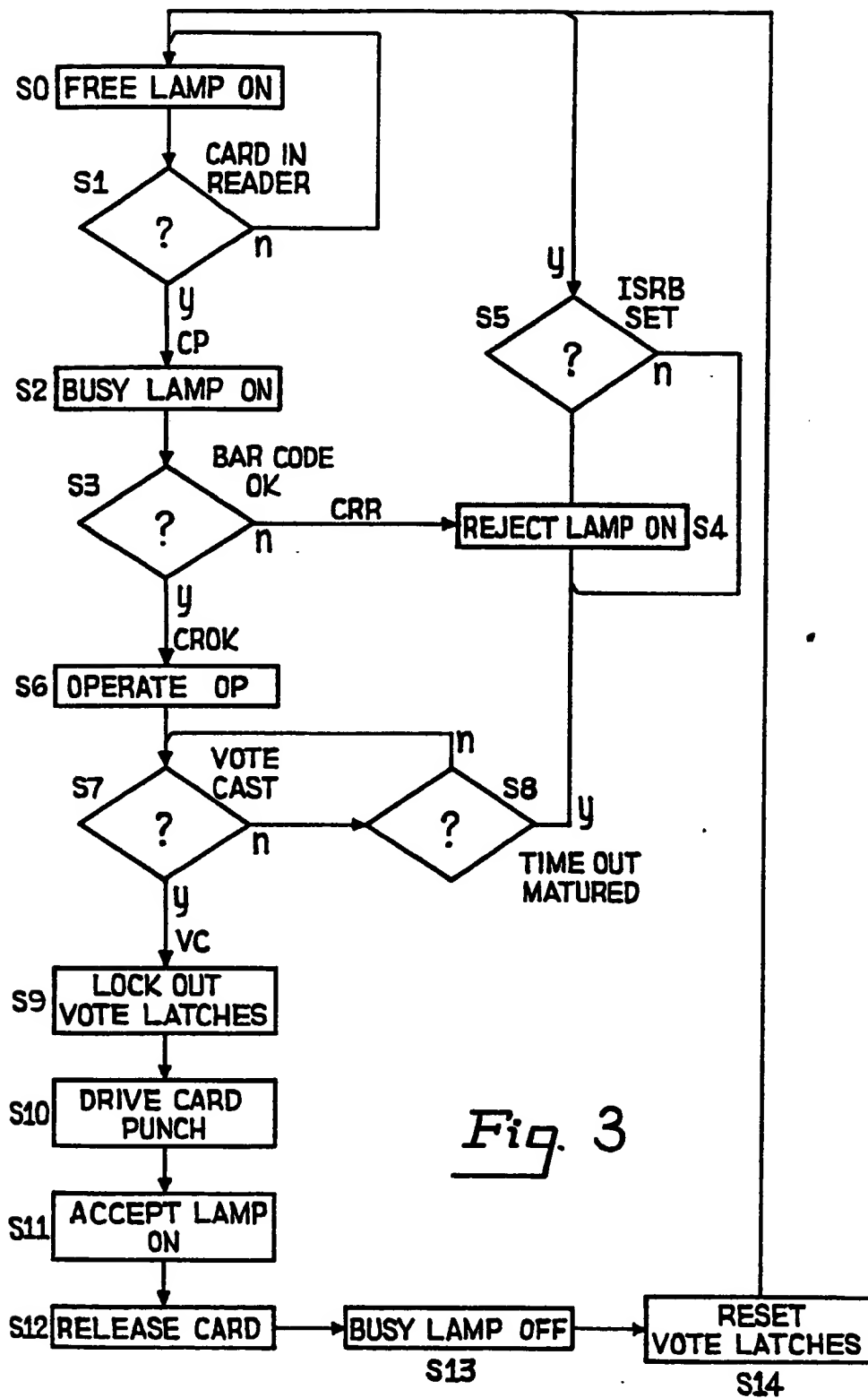
S13 BUSY LAMP OFF

S14 RESET VOTE LATCHES

Fig. 3

SPECIFICATION

Electronic voting machine

5 *Field of the invention*
The present invention relates to electronic
voting machines and is more particularly con-
cerned with the provision of a portable elec-
tronic voting machine which may be used to
10 replace the voting slip system without sub-
stantially altering the current electoral proce-
dures.

Prior art
15 In the current British electoral system, for
example, a voter is given a validated voting
slip carrying the voting selection after
identifying himself to the polling station staff
using the electoral roll. The voter then takes
20 the voting slip to a voting booth and marks
the required vote selection with a pencil cross.
After casting the vote the marked voting slip
is placed in a voting box which ultimately,
together with many other voting boxes, will
25 be taken to some central place for the vote
counting process. The handling of the voting
boxes and the voting slips is a very labour
intensive and consequently time consuming
and costly operation.
30 It is an aim of the present invention to
provide an electronic voting machine which
reduces the labour involved in the handling of
votes without substantially changing the sys-
tem as far as the voter is concerned.
35
The invention
According to the invention there is provided
a voting machine having (i) a selection presen-
tation area including a plurality of manually
40 operable electrical switching devices, one for
each vote selection, (ii) a plurality of electronic
counters, at least one for each vote selection
and adapted to register the operation of the
corresponding electrical switching device and
45 (iii) a vote selection mechanism locking ar-
rangement adapted to be unlocked by a
suitably coded card, the machine being ar-
ranged such that the reception of the suitably
coded card frees the vote selection mecha-
50 nism to allow a vote selection to be recorded
in the appropriate electronic counter and the
coded card is retained in the voting machine.
By such an arrangement each vote may be
recorded twice – once elctronically and also
55 physically on the coded card. In the event of
failure of the electronics the accumulated
coded cards can be used to recover the vote
result for the particular machine.
Typically the machine is "unlocked" by the
60 presentation of a bar coded (electoral roll) card
which may be given to the voter by the
polling staff or alternatively sent to his home
address. Also the coded card once identified
may be subjected to a hole punch operation
65 to record the vote actually cast.

The electronic voting machine is made in
portable form so that it can be removed from
a polling booth and transported to the central
vote counting station for read-out under the
70 control of the electoral Returning Officer. At
the central station the contents of the counters
are read-out electronically and may then be
totalised using computer-like equipment.
Such an arrangement substantially reduces
75 the human effort required to record the votes
cast and has the very significant advantage
that in the event of a electronic counting
failure the votes can still be recovered by
"reading" the punched coded cards in a
80 manner similar to that used to count voting
slips. Obviously the electronic read-out
method is substantially quicker than counting
votes by hand and each polling booth effec-
tively is provided with its own polling box
85 which again assists in reducing the labour
required to conduct a ballot.

*Description of one embodiment of the inven-
tion*
90 The invention will be more readily under-
stood from the following description of one
embodiment which should be read in conjunc-
tion with the accompanying drawings. Of the
drawings
95 *Figure 1* shows a schematic diagram of the
voting machine and a coded card
Figure 2 shows a block diagram of the
electronic equipment used in the machine,
while
100 *Figure 3* shows a flow diagram of the
sequence of operations of the machine in use.
Considering firstly Fig. 1 it will be seen that
the machine consists of a box 1 having a top
surface 2 which is used as the vote selection
105 presentation area, displaying, for example, the
names of the candidates (i.e. JONES, SMITH
and WILLIAMS). Typically this area is layed
out in the same manner as existing voting
slips with the addition of indicators (such as
110 lamps) to indicate that the machine is ready
for use (READY), the machine is in use
(BUSY), a vote has been accepted (VOTE
ACCEPTED) and a vote has been rejected
(VOTE REJECTED). By the side of each selec-
115 tion display area is a voting pad such as 3
(sign written with PRESS TO VOTE) which is
pressed to register a vote. Typically the ma-
chine is arranged to respond by illuminating
the VOTE RECORDED indicator. The vote se-
120 lection presentation area is arranged to be
adjustable so that say name carrying slides
can be fitted into it to adjust the selections
from one election to another.
The machine also includes an electoral offi-
125 cer reset button 4 which may be a key
operated electrical switch arranged to restore
the machine after a "VOTE REJECTED" se-
quence has occured. Such a sequence could
occur if an incorrectly coded card is inserted
130 into the coded card slot 5. The way in which

the coded card EC is used to free the voting machine will be seen later in this description.

Finally the machine includes a read-out connector, shown as 6 in Fig. 1, and this would
5 normally not be seen when the machine is mounted in the desk portion of the polling booth. The read-out connector 6 is used to connect the voting machine into an electronic vote registration and totalisation arrangement
10 in the central recording station.

The box is arranged to be of larger size than is required to simply accommodate the electronics as it is also used to accommodate the coded cards. Typically the machine is of the
15 order of 75 cms by 45 cms with a depth of say 45 cms. The coded cards can be quite small in size, of the order 5 cms by 2.5 cms and they are substantially smaller than conventional voting slips.
20 In operation a voter places his coded card EC into the slot 5. The machine validates the card (i.e. reads the bar code defined as BC and compares it with an internally programmed code) and illuminates the BUSY
25 indicator. The voter then presses the required "PRESS TO VOTE" pad and if accepted the "VOTE ACCEPTED" indicator is illuminated. Alternatively the "VOTE REJECTED" indicator may be illuminated and the electoral staff
30 would then be summoned to clear up the difficulty. In this case the reset button 4 is used by the electoral officer to reset the machine. Each vote is accumulated in a selection counter and also recorded on the coded
35 card using, for example, a hole punch machine to punch a hole at the required position of positions 1 to 7 on the card in accordance with the selection made.

Referring now to Fig. 2 consideration will
40 be given to the electronic and electrical equipment required for the portable voting machine. Typically the machine will be battery operated with the batteries recharged when the machine is not in use. The machine in-
45 cludes (i) a coded card reader CR, (ii) a flapped card stack bin CSB (iii) a number of vote or selection counters CA, CB, CC, (one for each vote selection) (iv) a number of vote pad activated switchings devices VBA, VBB,
50 VBC (one device for each vote selection), (v) a read-out logic arrangement R-OL and (vi) a machine sequence controller VSL. In addition four indicators VFI (READY), VBI (BUSY), VAI (ACCEPTED) and VRI (REJECTED) are pro-
55 vided together with some items of electronic equipment which will be described later when considering the operation of the machine.

The coded card reader CR consists of a card-present detector D, a bar code reader
60 BCR, a bar code acceptor logic BCAL, a local programmed bar code module LPM and a card punch CPE.

The operation of the equipment will be described with reference to Fig. 2 and Fig. 3.
65 Fig. 3 shows a flow diagram of the sequence of operations performed under the control of the sequence logic VSI. Typically this sequence control logic may be implemented using a suitably programmed micro-processor.
70 The following description will be sectionalised in accordance with the steps shown in Fig. 3.

As mentioned previously in the free state the READY illumination is lit and this is indicated at step SO in Fig. 3.
75

STEP S1　Is card in card reader?

The vote registration sequence is started by inserting a bar coded card EC into the card reader CR. The presence of the card is de-
80 tected by the detector D and the sequence logic exits from Step 1 on the y path to Step S2 causing the READY lamp to be extinguished. In the absence of a card EC the sequence control logic loops around steps SO
85 and S1 waiting for the entry of a card.

STEP S2　VOTER BUSY

In this step the sequence logic causes the BUSY indicator VBI to be switched on and
90 latched before performing step S3.

STEP S3　BAR CODE OK?

In this step the bar code is read from the card EC by the bar code reader BCR and the
95 result is compared with that stored in the local programmed bar code module LPM and communicated to the sequence control logic VSL. The local programmed bar code module LPM is manufactured as a plug-in device allowing
100 each machine to be uniquely encoded. If the code on the inserted card EC does not compare with that in LPM the bar code assessment logic BCAL will produce the card reject signal CRR causing steps S4 and S5 to be
105 performed. Alternatively, if the bar code read corresponds with the code in LPM, signal CROK is produced and step S6 is performed.

STEP S4　LIGHT VOTE REJECTED
110 In this step the VOTE REJECTED lamp VRI is lit and then step S5 is performed.

STEP S5　IS EDR KEY RESET?

The sequence control logic loops around
115 steps S4 and S5 keeping the VOTE REJECTED lamp lit until the key operated reset button is activated to reset the machine after a rejected vote.

120 STEP S6　OPERATE PS

This step is performed if the bar code equates to that in LPM in step S3. In this step the power switch PS is activated by the sequence control logic VSL to switch on the
125 power to the vote selection switching devices. The voter sequence control logic VSL now enters step S7.

STEP S7　VOTE CAST?
130 The sequence control logic will test the

output of the vote detector VD to see if one of
the vote selection pads has been pressed. The
sequence control logic performs a loop involv-
ing steps S7 and S8 looking for the operation
5 of a vote selection pad or the maturing of a
predetermined time-out period. If the time-out
period matures step S4 is entered and the
vote rejected.

When a vote selection pad is pressed the
10 ganged pair of electrical switches are closed
and one switch of the pair activates the vote
cast signal VC from the vote detector VD
which causes step S8 to be performed. At the
same time as the vote detector VD detects the
15 activation of one of the switches VBA, VBB or
VBC the corresponding voting latch circuit
VLA, VLB or VLC will be operated by the other
switch of the ganged pair to inject one pulse,
and one pulse only, into the corresponding
20 counter CA, CB or CC. Typically the voting
latch circuit VLA, VLB and VLC are arranged
to latch to the first switching of the vote
switching devices so that multiple operation of
the same vote pad results in the recording of
25 one vote only. The vote counters are binary
counters and to provide security against fail-
ures may consist of a triplicated array of such
counters for each vote selection.

30 *STEP S9   LOCKOUT VOTING LATCHES*
In this step the voting latch circuits VLA,
VLB and VLC are locked-out so that pressing
of their corresponding voting pads will not be
effective. This arrangement ensures that only
35 one vote is registered for each operation of
the machine. Step S10 is now performed by
the sequence control logic VSL.

STEP S10   DRIVE CARD PUNCH
40 In this step the vote detector VD is acti-
vated by signal VR to cause the vote selection
to be registered on the card EC by activating
the card punch equipment CPE. The card
punch equipment CPE consists of an electro-
45 magnetic hole puncher for each vote selection
and the vote detector selects which puncher is
activated as required.

STEP S11   DISPLAY VOTE ACCEPTED
50 In this step the sequence control logic VSL
illuminates the VOTE ACCEPTED lamp VAI
and then performs step S12.

STEP S12   RELEASE CARD
55 In this step the sequence control logic oper-
ates the flap control electro-magnetic CFL to
allow the card to fall into the card box CSB.

STEP S13   RESET BUSY LAMP
60 In this step the BUSY lamp VBI is turned
off to indicate that the voting process is
completed.

STEP S14   RESET VOTE LATCHES
65 In this step the "lockout" on the voting

latch circuits VLA, VLB and VCC applied in
step S9 is removed in preparation for the next
use of the machine.

The machine now returns to step S0 to
70 light the READY LAMP.

From the above it can be seen that succes-
sive vote selections signalled by the pressing
of the vote selection pads are recorded in the
corresponding binary counters CA, CB, CC as
75 appropriate and also recorded in the appropri-
ate point on the card EC by a punched hole.
Ultimately the voting machine will be taken
for read-out and the read-out logic R-OL,
conditioned by the read-out sequence signal
80 ROSS, will cause the contents of the counters
to be presented in parallel form in a predeter-
mined sequence to the read-out leads RO1-X.

The above description has been of one
illustrative embodiment only and the scope of
85 the invention is not intended to be limited by
it. Alternative arrangements will readily be
seen by those skilled in the art for example
the method of recording a vote on the coded
card is described as a punched hole arrange-
90 ment however alternative arrangements such
as ink jet markers of the like could be used.
Also the card is described as bar coded but
any suitable type of encoding such as mag-
netic stripe could be used. Finally the machine
95 has been described as being interrogated after
transportation to a central read-out office,
however with the use of telephone lines and
encoded modem equipment, the voting ma-
chines could be remotely read-out if required.
100
CLAIMS
1.   A voting machine having a vote selec-
tion presentation area inlcuding a plurality of
manually operable switching devices, one for
105 each vote selection and adapted to register
the operation of the corresponding switching
device and a vote selection mechanism lock-
ing arrangement adapted to be unlocked by a
suitably coded card, the machine being ar-
110 ranged such that the reception of the suitably
coded card frees the vote selection mecha-
nism to allow a vote selection to be recorded
in the appropriate counter and the coded card
is retained in the voting machine.
115   2.   A voting machine as claimed in claim 1
in which the coded card carries a bar-code
and the machine includes a bar code reader.
3.   A voting machine as claimed in claim 1
or 2 in which the machine includes means for
120 recording the recorded vote selection on the
coded card.
4.   A vote machine as claimed in claim 3
in which the machine includes a hole punch
arrangement adapted to punch a hole in the
125 coded card to record a vote selection.
5.   A voting machine as claimed in claim
1, 2, 3 or 4 in which the counters are binary
counters.
6.   A voting machine as claimed in any
130 preceding claim in which a counter read-out

arrangement is provided to allow the contents of the counters to be read-out from the machine.

7. A voting machine as claimed in claim
5 1, 2, 3, 4, 5 or 6 in which electronic arrangements are provided to ensure that only one selection is registered for each operation of the machine.

8. A voting machine as claimed in any
10 preceding claim in which the code carried by a coded card is compared with an internally stored code which is particular to the machine.

9. A voting machine as claimed in any
15 one of the preceding claims in which the operation sequence is controlled by a microprocessor.

10. A voting machine substantially as described in conjunction with the accompanying
20 drawings.